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produced in the median plane of the body or symmetrically on either side of it (and at the same time are equally intense) the difference-tone seems to be in the median plane within the head, sometimes mid-way between the ears. When both generating tones are on one side of the head the difference-tone is heard in or near the ear on that side and is not referred to the generating tones. When the generating tones are not equally intense, one being produced before one ear the other before the other, the difference-tone is heard on the side of the fainter generating tone—a result due apparently to the more favorable relation of intensities existing on that side. Dove, Stumpf and Thompson failed to hear the difference-tone with the generating tones in this position, but probably because of imperfect conditions. The 32 forms of experiment contributing these results, as well as notice of the effect of different positions of the generating tones upon the intensity of the "beats" and difference-tones, are set forth in the original. [These results are in harmony with the general principle that a sound is located upon the side on which it is most intensely heard; or if equally intense on both sides, in the median plane. REV.]

*Die Association successiver Vorstellungen.* H. MÜNSTERBERG. Zeitsch. f. Psychol. Bd. I, H. 2. 1890.

The theory of association here advocated by Münsterberg is that the connection of any two members of a memory series depends either on their more or less complete simultaneousness in consciousness (or the simultaneousness of their nervous correlates), or, if successive, on their connection with the members of a parallel motor series (made up of the reflex movements or tendencies to movement which attend sensory processes). Thus sensory image *a* is connected, because simultaneous, with motor impulse *A*, the latter with motor impulse *B*, and that in turn with sensory image *b*. Image *a* can thus call up image *b* indirectly though wholly lacking direct connection. In addition to a statement of the difficulty of conceiving the connection of neurological processes wholly successive, the author presents experiments going to show a connection by way of these motor accompaniments. The experiments fall into two groups. In the first written letters are exhibited in such a way that each letter was seen by itself for one second till from four to ten had been shown. The subject, Münsterberg himself, was required to fix the series in mind and at the end repeat the letters in order. He found that he was able to repeat seven letters without error, but reached the limit of his ability with a series of 10. The errors which he made, and this is the important point, were mostly the substitution of wrong letters, *almost never errors in order*; taking reproductions of series of all lengths only about 1 per cent. were affected by errors of this kind. In the second group the setting of the experiment was the same as in the first; but the subject, instead of being able to concentrate his mind on holding one letter till the next came or even to say them in his head, was deprived of such aids by being required to work problems in mental arithmetic aloud (such as adding continuously), while the letters were shown. The result was a fall of the limit of possibility from 10 to 7-letter series, and of that of perfect reproduction from 7 to 4 or 5. More important, however, is the fact that *the order of letters, even when the right ones were given, was very frequently wrong*. Of 100 4-letter series only 6 contained wrong letters, but 52 were wrong in order; of 100 5-letter series, 10 contained wrong letters and 64 a wrong order; and the 6-letter series were very much worse. The effect of simple distraction of attention shows itself in the fall of the limits of possible and perfect reproduction, but the errors in order must have another explanation. This is to be found in the fact that the mind was not at liberty to hold one letter till the next came (hence association by simultaneousness was

excluded) nor able to connect them serially by means of their natural reflex motor accompaniments, because the speech apparatus was fully occupied with the loud reckoning. There was therefore no means of serial connection left, though the letters were impressed on the memory singly. With this explanation the subjective observation of Münterberg during the experiments agrees.

The author holds that the serial connection in the motor series is quite another matter from that in the memory series. The point is an important one, for unless this is so he still has to account for one link in his chain, and to the reviewer's mind it should have had a much fuller and better demonstration. The experiments, however, are valuable and the paper, unlike those in the author's *Beiträge*, is brief and to the point.

E. C. S.

*Ueber negative Empfindungswerte.* Briefe von G. TH. FECHNER, herausgegeben von W. Preyer; (Schluss). Zeitsch. f. Psychol. Bd. I, H. 2.

The five letters given in this section continue the discussion of "negative sensations" upon the lines followed in the former section (Zeitsch. f. Psychol. Bd. I, H. 1; review, *Amer. Jour. Psychol.* III, p. 288), and bring the correspondence to a close, evidently without the surrender of either party. New analogies are introduced and Fechner makes clear his strict limitation of his formula and its deductions to *psycho-physic* phenomena, refusing to have it carried over to purely psychic matters and withholding assertion as to its applicability in purely physical ones. In the course of the letters reference is several times made to the views of Hartmann on the physiology of consciousness.

### III.—CRIMINOLOGICAL.

BY ARTHUR MACDONALD, PH. D.

*Tipi di criminali nati,* GUIDO ROSSI e S. OTTOLENGHI, Archivio di Psichiatria, Scienze Penale ed Antropologia Criminale, Vol. XI, Fasc. 1, Torino, 1890.

As an example of the way in which criminals are studied by the Italian specialists, we give the details of a single case.

The writers investigated two cases of typical born-criminals. The first case (by Rossi) is as follows: S. C., 38 years of age, born in Turin, a type-founder by trade, condemned twice; the first time, ten-year sentence for cruelty to father. While in prison he attempted suicide twice. Being unable to work, he wrote his history upon a vessel. Always suffered sensations of heat in the head; was subject to vertigo; had an alcoholic attack and epileptic prison insanity, *folia carceraria epilettica*, during which he broke the glass in the window, for having been punished excessively; did not think in such moments of the possibility of being punished again; had a true morbid epileptical hypochondria. His physical examination gave: pallid skin, thin chestnut hair, abundant beard, thin moustache, blue iris; nose long and crooked; teeth: median incisors hypertrophied, the lateral decayed; slightly projecting ears, squint in left eye, paralysis of the eyebrows. Craniometry: anterior-posterior diameter, 182 mm.; transverse, 151 mm.; anterior-posterior curve, 340; transverse, 317; total circumference, 540; cephalic index, 83; cranial capacity, 1530; a depression at the union of the frontal and parietal, not evident whether it is due to a wound or not; lacks the ethnic type; a scar on right hand arising out of a dispute after gambling. Sensibility: with Faradaic current, the right hand feels at 32, the left hand at 35; touch gives 3 mm. for left and 2 mm. for the right. Meteorological sensibility is moderate; two or three days before bad weather he is restless. He is credulous; was made to see a bottle